Jurnal Ilmiah Farmako Bahari
Journal Homepage : https://journal.uniga.ac.id/index.php/JFB

Evaluation of Antiacne Patch Preparations from a Combination of Lemon Juice (*Citrus limon* L.) and Ethanol Extract of Pure Honey (*Honey bee*)

Nadya Tsurayya*, Ubaydullah Choir, Agus Kurniawan, Isnani Handayanti

Department of Pharmacy, Faculty of Health Sciences and Pharmacy, University of Gunadarma, Jl. Margonda Raya No. 100, Depok, West Java, 16424, Indonesia

*Corresponding author: Nadya Tsurayya (tsurayya.nadya@gmail.com)

ARTICLE HISTORY

Received: 6 November 2025 | Revised: 22 January 2026 | Accepted: 28 January 2026

Abstract

Acne vulgaris is one of the most common dermatological diseases, affecting individuals of all ages, particularly during adolescence. One of the causes of acne vulgaris is the bacterium *Cutibacterium acnes*. Acne vulgaris is usually characterized by comedones, papules, pustules, or nodules. Factors influencing acne include genetics, psychological factors, hormones, bacterial infection, and sebaceous gland activity. One regularly used treatment for acne vulgaris is acne patches. With the aid of natural ingredients such as lemon juice and pure honey, an alternative treatment for acne vulgaris can be developed. Lemon juice (*Citrus limon* L.) can be utilized as an antibacterial agent against *Cutibacterium acnes* due to its flavonoid content, which has biological activity as an antibacterial. Meanwhile, pure honey (*Honey bee*) is an antioxidant that can kill bacteria and germs, causing itchy acne on the skin, and can help fade acne scars. The study employed a laboratory experimental design. This research aimed to formulate an anti-acne patch preparation containing a combination of lemon juice (Citrus limon L.) and an ethanol extract of pure honey (Honey bee) that would exhibit good physical stability. Evaluation of the anti-acne patch preparation included organoleptic tests, pH, weight uniformity, patch thickness, moisture absorption, and antibacterial activity tests against *Cutibacterium acnes* using the disk diffusion method. The results indicated that the anti-acne patch exhibited favorable physical properties. The combination of lemon juice and ethanol extract of pure honey enhanced antibacterial activity against *Cutibacterium acnes*. The antibacterial activity test results showed that the combination of lemon juice and ethanol extract of pure honey in the anti-acne patch at a concentration of 14% had the highest antibacterial activity, with an inhibition zone diameter of 51.38 mm.

Keywords: acne vulgaris, honey, lemon juice, patch

Introduction

Acne is a common skin condition that typically affects the face. Causes of acne are multifactorial, with various factors contributing to increased prevalence, including exposure to air pollution, consumption of high-fat foods, and high stress levels.[1]

The Global Burden of Diseases (GBD) states that approximately 85% of people aged 12-25 have experienced acne vulgaris.[2] The World Health Organization (WHO) states that 20% of women experience severe acne.[3] To reduce this prevalence,

researchers can develop products made from natural ingredients that have effective and safe antibacterial activity for treating acne vulgaris. Fruits that can be utilized as antibacterial against the bacteria *C. acnes* are squeezed lemon (*Citrus limon* L.) and pure honey (honey bee). The usual *Citrus limon,* known as the lemon, is included in the family *Rutaceae* and is generally cultivated in South Asian countries. Lemons are rich in supplemental nutrition that contains carbohydrates, fats, proteins, and vitamins such as thiamine, riboflavin, niacin, folic acid, pantothenic acid, folate, choline, and are a rich source of vitamin C, citrate, flavonoids, saponins, limonoids, tannins, and terpenoids, which are active natural compound substances that exist in squeezed lemon fruit**.**[4] Flavonoid content in lemons has biological effects, such as antibacterial, antifungal, antidiabetic, anticancer, and antiviral.[5]

Pure honey also contains compounds such as inhibin, hydrogen peroxide, and antioxidants that can help clear acne and kill bacteria, which is why honey can cause skin itching. Honey has characteristic osmotic properties that help clean wounds, absorb excess water, and promote the release of hydrogen peroxide, which is used in acne treatment. Honey is naturally sour, so it is very effective at preventing and reducing the growth of bacteria, containing anti-inflammatory substances that prevent inflammation of the wound, as well as containing very good natural bacteria that serve to reduce acne and prevent the emergence of new pimples.[6]

A patch is a transdermal delivery system that delivers medication through the skin into the bloodstream. The main component of the patch formulation is a polymer used to control the release of the medicine. Several factors, including the types and amounts of active ingredients and additives used, influence the properties of physique patches. Material active in use that is synthetic or herbal.[7]

Patch preparations offer several benefits, including preventing the metabolism of the medicine, preventing damage to the channel that digests the medicine, facilitating the release of the medicine when toxicity occurs, increasing patient compliance with lower-frequency dosing, being safe for use in children, and allowing self-administration.[8] An innovation in manufacturing preparations that attempts to change preparations to improve patient compliance, security, and comfort is manufacturing patch preparation in extract form. A good patch should have low depreciation, be dry, have low power, have low water absorption, and be thin, smooth, uniform, and physically flexible.[9]

Research reported that acne patches formulated with natural tea tree oil (TTO) received positive evaluations, indicating potential for development as acne patches.[10] Another study reported that lemon juice can inhibit the growth of P. acnes.[11] Another study reported that honeybee against P. acne was categorized as highly inhibitory.[2] Based on several research reports, studies on the development and evaluation of acne patches from a combination of lemon squeeze and honeybee are still limited so that researchers are interested in researching the formulation of a stock *anti-acne patch* with the active material of squeezed lemon fruit (*Citrus limon* L.) and pure ethanol honey extract (*honeybee),* which can produce good stability and physical condition of the preparation. Researchers will focus on the preparation of this anti-acne patch on acne papules (papules), pustules (pustules), and cysts (cysts).

Material

Autoclave (Hirayama), laminar air flow (Nuve LN120), pH meter (Eutech), waterbath (Arec), oven (Memmert), analytical scales (Presica), loop, petridisk, and glassware. Lemon (*Citrus lemon* L.), extract ethanol pure honey (*honey bee*), *Cutibacterium acnes,* agar medium, glycerin, hydroxypropyl methylcellulose (HPMC), carboxymethyl cellulose (CMC), methyl paraben, polyvinyl alcohol (PVA), propylene glycol, tween 80*,* demineralized water.

ISSN: 2087-0337
E-ISSN:2715-9949

Method

Plant Determination

The determination plant aims to ensure accuracy, prevent sampling errors and contamination from other plants, and ensure that plant morphology is studied in accordance with the literature.

Making Squeezed Lemon Fruits

Some yellow lemons are freshly cut transversely with a knife after being rinsed with running water to remove any dirt or pesticides adhering to the skin. Subsequently, manually squeeze it with a tool to extract juice. In a clean container, place the filtered juice from the reservoir, then squeeze it to separate the lemon seeds and pulp. Juice: This is the lemon that is used in this study.[4]

Making Extract Ethanol from Pure Honey

Extracting pure ethanol from honey started with weighing the honey that had been confirmed pure. Honey was then mixed with ethanol in a certain proportion and stirred until homogeneous. This mixture is extracted by soaking it in ethanol for several days, with stirring occasionally. After the extraction process is complete, the mixture is filtered to separate the solid from the fluid extract. Extract ethanol, then evaporate using a rotary evaporator to remove the solvent so that the obtained extract, ethanol, and honey are pure, concentrated, and ready to be used in the anti-acne dosage form.

Total Flavonoid Level Testing

Solution standard 100 ppm quercetin was pipetted in 0.2 mL, 0.4 mL, 0.6 mL, 0.8 mL and 1 mL, respectively, then each was mixed with 3 mL of methanol P.A, 0.2 mL $AlCl_3$ 10%, 0.2 Ll CH_3COOK 1 M, and distilled water until the signal limit pumpkin measured 10. mL. After that, measure its absorbance at the wavelength of 400-800 nm.[12]

Pipette 2 mL of lemon juice, then add 3 ml of methanol P.A, 0.2 mL of $AlCl_3$ 10%, and 0.2 mL of CH_3COOK, and add distilled water until the sign borders on the pumpkin measure 10 mL. Next, it measured its absorbance at the maximum wavelength of 435 nm.[12]

Formulation of Anti-acne Patch

Table 1. Anti-acne *Patch* Formula of Combination Lemon Fruit *(Citrus limon L.)* and Ethanol Extract of Pure Honey (*Honey bee*)

Materials	Function	Concentration (%)			
		F0	FI	FII	FIII
Lemon Juice (*Citrus limon* L.)	Active Ingredients	0	7	0	0
Extract Ethanol from Pure Honey (*Honey bee*)	Active Ingredients	0	0	7	0
Combination of Lemon Juice (*Citrus limon* L.) and Ethanol Extract of Pure Honey (*Honey bee*) 1:1	Active Ingredients	0	0	0	14
HPMC	Polymer	1,25	1,25	1,25	1,25

ISSN: 2087-0337
E-ISSN:2715-9949

Table 1. (Extension)

Materials	Function	Concentration (%)			
		F0	FI	FII	FIII
CMC	Polymer	0,25	0,25	0,25	0,25
PVA	Polymer	2	2	2	2
Methyl Paraben	Preservative	0,3	0,3	0,3	0,3
Propylene glycol	Plasticizer	15	15	15	15
Glycerin	Humectan	10	10	10	10
Tween 80	Humectan	3	3	3	3
TEA	Emulsifier	1	1	1	1
Stearic acid	Emulsifier	0,018	0,018	0,018	0,018
Demineralized water	Solvent	ad 100	ad 100	ad 100	ad 100

Preparation and Production of Anti-acne Patch

An anti-acne patch preparation was previously formulated with squeezed lemon juice (Citrus limon L.) and pure honey (honey bee) at a 1:1 ratio. Then, the weighed HPMC material is added to the distilled water heated in the first beaker, stirred until homogeneous, and covered with aluminum foil. Tween 80, PVA, and demineralized water are added to the second beaker, and the mixture is stirred until homogeneous. Propylene glycol, glycerin, TEA, stearic acid, and methylparaben are added to the third beaker, and the mixture is stirred with a magnetic stirrer until homogeneous. Polymer was then added to the second beaker and mixed until dissolved and homogeneous. If stirring is initiated at this stage, the preparation must be left to stand for 1 × 24 h to allow bubbles to dissipate. Preparations placed in a mold are incubated in an oven at 50°C ± 7 days. Observation is performed daily until the patch forms.[13]

Anti-acne Patch Evaluation

Organoleptic Test

Testing organoleptic patch preparation can be conducted using sensory attributes such as shape, color, and aroma, and the patches can be observed for 24 hours.[13]

pH Test

Place the patch in the porcelain cup containing 5 mL of demineralized water (pH 6.5) and incubate at room temperature for 2 hours. The pH is determined by placing universal pH indicator paper on the patch's surface. The pH range that can be tolerated to be non-irritating to skin is 4.5-6.5.[14]

Uniformity Weight Test

As many as 10 patches were weighed, then the % CV was calculated using Microsoft Excel.[13]

Thickness Test of Patch

Patch thickness testing can be done using a caliper tool by measuring one by one at three different points on four patch preparations.[13]

Moisture Absorption Test

Moisture absorption testing is carried out by weighing, storing at room temperature and 40°C for 24 hours, and then weighing again. Calculate the percentage of moisture absorption using the formula [(initial weight - final weight) / (initial weight x 100%)].[13]

ISSN: 2087-0337
E-ISSN:2715-9949

Antibacterial Activity Testing

The antibacterial activity test uses the pour plate method. In the pour plate method, approximately 100-200 micrometers of test bacterial suspension is aseptically placed into a sterile Petri dish. Next, approximately 15 mL of liquid NA media, still at 45°C, is poured into the Petri dish containing the bacterial suspension. The dish is then gently swirled in a figure-eight motion to distribute the bacteria evenly across the entire surface and layers of the medium. The dish is left to solidify completely and then incubated for 24 hours at 37°C. The resulting clear zone is observed using a vernier caliper.[15]

Result

Pure Honey Ethanol Extract (*Trigona sp*.)

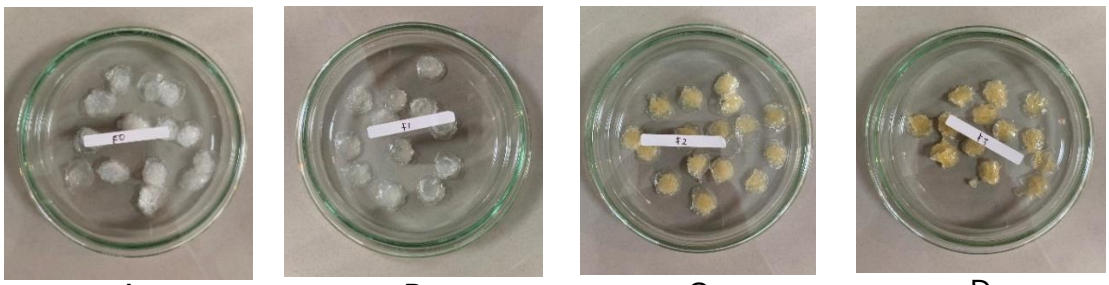
Table 2. Result of Ethanol Extract Pure Honey (*Trigona sp*.)

Component	Pure Honey Sample
Solvent	Ethanol 96%
Amount of simplisia	400 g
Amount of macerate	3 L
Amount of thick extract	276,8 g
Extract yield	69,2%

Evaluation of Patch

Table 3. Evaluation of Antiacne Patch

Parameters		Result			
		F0	FI	FII	FIII
Organoleptic test	Texture	Circle	Circle	Circle	Circle
	Appearance	White	Yellowish white	Yellow	Yellow to orange
	Odor	Odorless	Lemon	Honey	Lemon and honey
pH test		6,11	6,12	6,15	6,19
Uniformity weight test		1,276	1,427	1,815	1,977
Thickness test of the patch		0,35	0,54	0,40	0,48
Moisture absorption test		1,097%	0,210%	0%	0,050%



A B C D

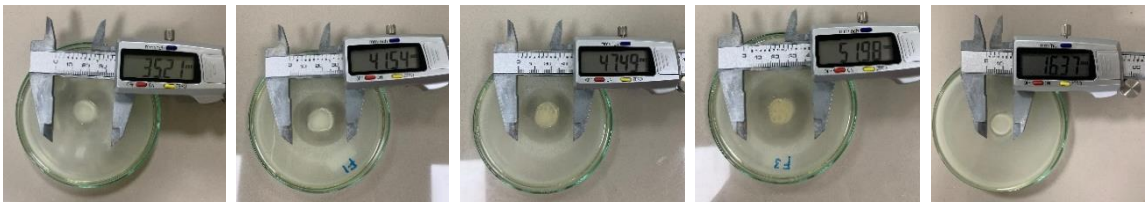
Figure 1. Formula of antiacne patch, (A) formula 0 (base), (B) formula I (squeeze lemon 7%), (C) formula II (extract ethanol pure honey 7%) and (D) formula III (active substance combination 1:1)

ISSN: 2087-0337
E-ISSN:2715-9949

Antibacterial Activity of *Cutibacterium acnes (C. acnes)* Bacteria

Table 4. Result: Antibacterial Activity of Antiacne Patch on Each Formula against *C. acnes* Bacteria

Formulation	Resistance (mm)	Antibacteria Activity
Formula 0	35,21	Very strong
Formula I	41,54	Very strong
Formula II	47,49	Very strong
Formula III	51,98	Very strong
Positive control	16,37	Strong



Formula 0 | Formula I | Formula II | Formula III | Positive control

Figure 2. Inhibition diameter value of each formulation

Discussion

Plant Determination

The process of identifying the name or type of a certain plant is known as plant identification. The purpose of identification is to determine certain plant species. This is because plants are used in various contexts, including research, as material for standard drugs, and so on. Therefore, it is important to use the right plants to ensure the most objective results.[16] The determination of lemon fruit is done in the laboratory of the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Indonesia, and Herbarium Depokensis (UIDEP) was taken from the Plant Research Center for Spices and Medicine (Balitro). Meanwhile, the determination of pure honey was conducted at the PT—Palapa Muda Perkasa Laboratory, taken from the Plant Research Center for Spices and Medicine (Balitro).

Extraction

This research used the maceration extraction method. The principle of maceration is based on the ability of the solvent solution to penetrate cell walls and enter the cell cavities containing various active components. The active substances will be distributed or dissolved in the solvent solution.[17]

A 400 g sample of unextracted pure honey was macerated with 96% ethanol in three stages to extract all the active ingredients contained in the pure honey sample. The macerate formed in stages I, II, and III was thickened using a rotary evaporator. The yield of the pure honey sample is shown in Table 2.

Total Flavonoid Level Testing

The purpose of determining flavonoids is to see the high content of total flavonoids; the higher the flavonoid content, the higher the activity.[18] In this study, to determine total flavonoid levels in samples, quartz was used as a solution standard with a series of concentrations of 6, 8, 10, 12, and 14 ppm. Use quartz as a solution standard due to

quercetin being a flavonoid group of flavonols that have a keto group at C-4 and a hydroxyl group on the neighboring C-3 or C-5 atom from identical flavones and flavonols with flavonoid compounds.[19] Measurement of standard results of quercetin obtained plotted a linear regression, namely y = 0.0319x + 0.0172, with the R^2 value obtained of 0.998.

In the measurement of total flavonoid compounds, the sample is mixed with 3 mL of ethanol and then with 10% $AlCl_3$ reagent, which forms a complex that shifts the absorption toward longer wavelengths, producing a clearer yellow color. The presence of the additional reagent, potassium acetate, is intended to maintain long waves in the area's appearance.[20] Next, the incubation process is carried out for 30 minutes, aiming for the reaction to be ongoing and perfect so that the intensity of the color formed is maximum.[19] So that from the results of this study, it was obtained that the total flavonoid content of the juice of the lemon fruit (*Citrus limon* L.) is 29.34 mg QE/g, based on previous research, which obtained a total flavonoid content of 38.42 mg QE/g from squeezed lemon fruit.[12] The difference that could happen is because plants of the same species adapt in a way that is very different from the conditions of temperature that relate to the minimum, optimum, and maximum for life overall.[21]

Antiacne Patch Preparation

Making a stock patch combination squeezes fruit lemons and extracts pure ethanol honey as purposeful innovation modifies preparations to improve compliance, safety, and patient comfort. In addition to low-level depreciation, good dry and power, and good water absorption, a good patch should be thin, flexible, uniform, and smooth.[22] The main components in manufacturing stock anti-acne patches that affect the characteristic physique of the *patch* are polymers[23], namely HPMC, CMC, and PVA, a combination polymer that can repair characteristic hydration, rate degradation, and mechanical strength.[24] Methylparabenis used as a preservative because stock anti-acne patches have water content that can cause the occurrence of contamination by microbes. Next, propylene glycol is used as a plasticizer, which imparts elasticity and resilience to the stock patch. In the material, glycerin and Tween 80 are used as humectants; in addition to serving as solvents, they can increase viscosity.

Antiacne Patch Evaluation

The evaluation stock patch is shown in Table 3. This organoleptic evaluation was conducted to determine physical characteristics observable through the five senses. Observation of this organoleptic through the color, shape, and aroma of the preparation patch in Figure 1. In the preparation, they have the same form, namely, thin and round, but each formula has different colors and aromas. In formula 0 preparations, the color is white and natural, and there is no aroma because the patch contains no active substance and only a transverse base. Then, in formula I, the patch *was* colored yellowish-white and aromatic, typical of lemon, because of the existence of the active substance from the squeezed lemon fruit. In formula II, the preparation has its own yellow color and scented patch, typical of honey, because of the existence of the active substance, which is pure honey. Next, the last step in formula III is the preparation of the own color combination, namely yellow to orange, and the typical honey and orange aroma, because the color and aroma are derived from the second active substance.

pH test evaluation aims to minimize irritation during application by adjusting the skin's pH—results of pH testing on the preparation patch for average test results, which is 6.14. Where in formula 0 it is 6.11, formula I is 6.12, formula II is 6.15, and finally, formula III is 6.19. This shows that the pH of the preparation is good and appropriate, with the condition that it is between 4.5 and 6.5.[14]

Evaluation of the uniformity test weight seen from the mark standard: the smaller the data deviation from testing, the lower the mark deviation from the standard, and vice versa. Test results show that each formula has a uniformity weight that is not far from significant: 1.276 g for formula 0, 1.427 g for formula I, 1.814 g for formula II, and 1.977 g for formula III, resulting in an average value of the weight patch of 1.623 g. This value was calculated using the coefficient of variation (CV), which is 0.2832%. The weight patch is considered uniform because its coefficient of variation (CV) is ≤5%.[6]

Evaluation of the patch thickness test is very influential to the titration substance active in the skin; the thinner the patch, the more the titration substance will be active in the skin, which will be better because the media for the substance active will have a small shift.[1] Results show that the average on the stock patch created produces < 1 mm, so that the titration substance active on the patch against the skin has good penetration. Thickness patches can also be influenced by the characteristic physique patch, where a thin patch will be more easily used and more accepted in its use.[25]

The power test evaluates the ability to absorb humidity. A patch absorbs humidity. The smaller the mark percentage power absorbs humidity, the more it produces a patch that is relatively more stable and protected from contamination by microbes; on the contrary, the larger the mark percentage power absorbs humidity, the more it will produce a missing patch that is stable and contaminated with microbes.[26] Shows that the percent power absorbed by humidity in each formula (F0, FI, FII, and FIII) is 1.097%, 0.210%, 0%, and 0.050%, respectively. Based on these results, the Power Absorb Humidity Patch on each relative formula is small, so that the generated patch can be stated to be relatively stable, and it can be protected from microbial contamination.[27]

Antibacterial Activity Test of Antiacne Patch to *C. acnes* bacteria

On testing activity antibacterial to *C. acnes*, as in Figure 2, formula 0 has a DDH value of 35.21 mm, a value that is a sufficiently strong DDH value due to the existence of materials that can result in antibacterial activity, that is, HPMC material. This HPMC material remains stable at room temperature, even after long-term storage. Previous research also indicates that HPMC exhibits the highest physical stability.[22] Besides its strong resistance to attack microbes, the use of HPMC as a hydrophilic base has several benefits, such as the powder spreading well on the skin, cooling properties, non-clogging skin pores, easy cleaning with air, and release of effective medicine.

In the formula, I have my own DDH value of 41.54 mm, due to the existence of the active natural substance that is squeezed from the lemon fruit. Flavonoid content in lemon juice exhibits broad biological activities, including antibacterial, antifungal, antidiabetic, anticancer, and antiviral activities.[5] According to another research, the citrus species contains limonoids, which are considered capable of opposing isolated bacteria clinically.[28] Limonoids from lemon show good antibacterial and antifungal activity. According to another research, essential oils with high content of monoterpenes and sesquiterpenes, especially limonene, have antibacterial activity too.[29]

In formula II, it has its own DDH value of 47.49 mm, due to the existence of the active natural substance, which is pure ethanol-extracted honey. The content it contains is pure honey, its own content, with high sugar and an acidity of pH of the compound from flavonoid groups, glycosides, and hydrogen peroxide.[29] According to the previous research, which conducted testing of Trigona sp. honey on the bacteria *C. acnes*, there is an existing characteristic activity indicated by antibacterial activity with the formation of an inhibition zone.[30] Formation of an inhibition zone shows an indication of the existence of antimicrobial or antibacterial activity.[18]

In formula III, it has the power diameter value, the highest barrier, with a DDM value of 51.98 mm, because in this formula, it contains two active substances: a combination of squeezed lemon fruit (Citrus *limon* L.) and pure extract of ethanol honey (honeybee)

ISSN: 2087-0337
E-ISSN:2715-9949

with a 1:1 ratio. When the combination of substances exists, the second substance is active and exhibits its own characteristic antibacterial activity; the larger, the better. Second, the combination is highly effective for preparing this anti-acne patch because both active substances share the same characteristics: sufficient antibacterial activity and a clear separation phase. According to previous research, interactions between two or more compounds can produce an effect that is quantitatively greater than that observed when each is used singly.[26]

Conclusion

A combination of squeezed lemon (Citrus limon L.) and pure ethanol extract of honey (Honey bee) can make an effective anti-acne patch with good physical characteristics. Formulation III shows the highest concentration, indicating that it has the greatest antibacterial activity, with a power diameter value of 51.98 mm.

Acknowlegment

The authors would like to thank the Laboratory of Pharmacy at Gunadarma University for facilitating access to the instruments used in this research.

Reference

1. Gunarti NS. Pemanfaatan ekstrak daun jambu biji (Psidium guazava) sebagai gel facial wash antijerawat. Pharma Xplore J Ilm Farm. 2018;3(2):199–205.
2. Guguluș DL, Vâță D, Popescu IA, Pătrașcu AI, Halip IA, Mocanu M, et al. The epidemiology of acne in the current era: trends and clinical implications. Cosmetics. 2025;12(3):1–16.
3. Esmiralda N, Purwati K, Rahmawati A. Hubungan perilaku penggunaan perawatan kulit wajah terhadap kejadian akne vulgaris pada mahasiswi Universitas Batam. Zo Kesehat J Ilmu Kesehat. 2025;19(1):11–8.
4. Dewi KEK, Habibah N, Mastra N. Uji daya hambat berbagai konsentrasi perasan jeruk lemon terhadap bakteri Propionibacterium acnes. JST (Jurnal Sains dan Teknol. 2020;9(1):86–93.
5. Priyambodo RA, Zainal NH. Daya anti bakteri air perasaan buah lemon (Citrus lemon (L) Burm.F.) terhadap Streptococcus mutans dominan karies gigi. Media Kesehat Gigi Politek Kesehat Makassar. 2019;18(2):58–64.
6. Umah K, Herdanti O. Masker madu berpengaruh pada penyembuhan acne vulgaris. Journals Ners Community. 2017;8(2):179–87.
7. Rahmadani RA, Bulkis S, Budiman MA. Potensi budidaya kurma di Indonesia ditinjau dari perspektif ekonomis dan ekologis. In: Proceedings of National Seminar on ASBIS (Applied Science, Business, and Information Systems). 2017. p. 427–37.
8. Jamila IM. Pengaruh ekstrak buah kurma (Phoenix dactylifera L.) sebagai antioksidan terhadap penebalan epitel dan diameter lumen tubulus ginjal mencit betina yang dipapar rhodamin B. Universitas Islam Negeri Maulana Malik Ibrahim Malang. 2019.
9. Pratama AN, Busman H. Potensi antioksidan kedelai (Glycine max L) terhadap penangkapan radikal bebas. J Ilm Kesehat Sandi Husada. 2020;11(1):497–504.
10. Bernadette I. Pedoman tatalaksana akne di Indonesia resume hasil Indonesia acne expert meeting edisi III. 2015.
11. Nurhidayah, Siregar L, Arhamni A. Efficacy test of lemon juice (Citrus limon) on acne to inhibit the growth of propionibacterium acnes 2025. J Soc Res [Internet]. 2025;4(12):2016–23. Available from: http://ijsr.internationaljournallabs.com/index.php/ijsr2016
12. Pravita CS, Dhurhania CE. Penetapan kadar flavonoid total perasan lemon (Citrus limon (L.) Osbeck) secara spektrofotometri UV-Vis. Heal Sci Pharm J. 2023;7(1):44–53.

13. Hamzah S, Yanti NI, Isnaini N, Rahmi N. Uji stabilitas fisik formulasi sediaan patch antiacne kombinasi ekstrak etanol buah kurma sukkari (Phoenix dactylifera) dan madu murni (Honey bee). Med Sains J Ilm Kefarmasian. 2023;8(3):901–10.
14. Rajab NA, Jawad MS. Formulation and in vitro evaluation of piroxicam microsponge as a tablet. Int J Pharm Pharm Sci. 2016;8(2):104–14.
15. Ningsih AP, Nurmiati, Agustien A. Uji aktivitas antibakteri ekstrak kental tanaman pisang kepok kuning (Musa paradisiaca Linn.) terhadap Staphylococcus aureus dan Escherichia coli. J Biol Univ Andalas (J Bio UA). 2013;2(3):207–13.
16. Roring N, Yudistira A, Lolo WA. Standardisasi parameter spesifik dan uji aktivitas antikanker terhadap sel kanker payudara T47D dari ekstrak etanol daun keji beling (Strobilanthes Crispa (L.) Blume). Pharmacon. 2017;6(3):176–85.
17. Addisu S, Assefa A. Role of plant containing saponin on livestock production; a review. Adv Biol Res (Rennes). 2016;10(5):309–14.
18. Muharni, Fitrya, Farida S. Uji aktivitas antibakteri ekstrak etanol tanaman obat suku Musi di kabupaten Musi Banyuasin, Sumatera Selatan. J Kefarmasian Indones. 2017;7(2):127–35.
19. Azizah Z, Zulharmita, Wati SW. Skrining fitokimia dan penetapan kadar flavonoid total ekstrak etanol daun pare (Momordica charantia L.). J Farm Higea. 2018;10(2):163–72.
20. Chang CC, Yang MH, Wen HM, Chern JC. Estimation of total flavonoid content in propolis by two complementary colorimetric methods. J Food Drug Anal. 2002;10(3):178–82.
21. Hanani E. Analisis fitokimia. EGC; 2014.
22. Hasyim N, Faradiba, Baharuddin GA. Formulasi gel sari buah belimbing wuluh (Averrhoa bilimbi L.). Maj Farm dan Farmakol. 2011;15(1):5–9.
23. Arifin A, Iqbal M. Formulasi dan uji karakteristik fisik sediaan patch ekstrak etanol daun kumis kucing (Orthosiphon stamineus). J Ilm Manuntung. 2019;5(2):187–91.
24. Patel NA, Patel NJ, Patel RP. Design and evaluation of transdermal drug delivery system for curcumin as an anti-inflammatory drug. Drug Dev Ind Pharm. 2009;35(2):234–42.
25. Harro JM, Peters BM, O'May GA, Archer N, Kerns P, Prabhakara R, et al. Vaccine development in Staphylococcus aureus: taking the biofilm phenotype into consideration. Vol. 59, FEMS Immunology and Medical Microbiology. 2010. p. 306–23.
26. Fitriani A, Dewi N, Budiarti LY. Efek antibakteri sediaan tunggal dan kombinasi air perasan jeruk nipis dan madu terhadap Streptococcus mutans. J Kedokt Gigi. 2016;1(2):39–43.
27. Hermanto FJ, Nurviana V. Evaluasi sediaan patch daun handeuleum (Graptophyllum griff L) sebagai penurun panas. J Kesehat Bakti Tunas Husada J Ilmu-ilmu Keperawatan, Anal Kesehat dan Farm. 2019;19(2):209–17.
28. Gattuso G, Barreca D, Gargiulli C, Leuzzi U, Caristi C. Flavonoid composition of citrus juices. Molecules. 2007;12(8):1641–73.
29. Zu Y, Yu H, Liang L, Fu Y, Efferth T, Liu X, et al. Activities of ten essential oils towards Propionibacterium acnes and PC-3, A-549 and MCF-7 cancer cells. Molecules. 2010;15(5):3200–10.
30. Andini DT, Kuspradini RRH, Kusuma IW, Rosamah E. Beepoleen Tetragonula testaceitarsis antibacteria (Propionibacterium acnes) test. MCTrops. 2020;1(1):18–23.